USAF Composite Sustainment
An AFRL Perspective

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Air Force Advanced Composites Office

Overview

- Challenges
- AFRL
- Materials and Manufacturing Directorate
- Systems Support Division
- Steps of Supportability
- Specific Projects
- Collaborations
- Final Thoughts

Challenges

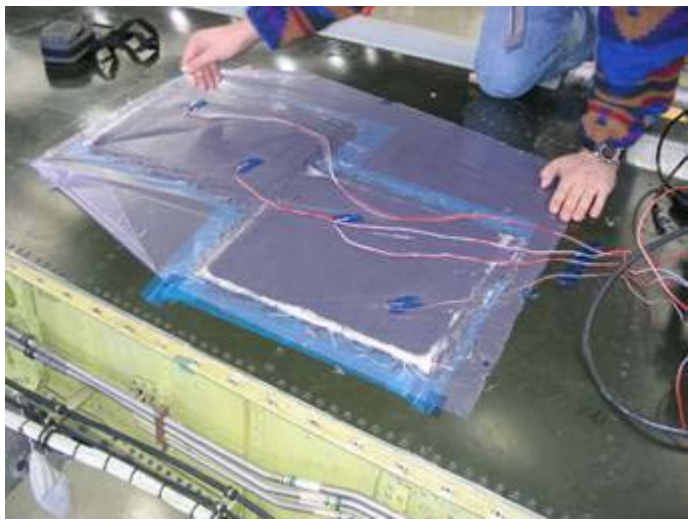
This Is What We Need to Be Able to Fix on a Composite Airplane

Challenges

But Not All Need for Repair Is Battle Damage Like This:

Challenges

Repairs of Corrosion and Other Small Damage Is Also Very Important



Challenges

There Can Also Be Maintenance Induced Damage That Is Difficult to Fix…….

Challenges

…….And We Can't Fix Everything!

Challenges

- **Sustainment Is Not Just Repair and Maintenance**
- **Sustainment Covers Entire Life Cycle From Raw Materials to Disposal of Used Airplanes and Parts**

Challenges

- **Challenge Is to Do More With Less and Do It Faster, Cheaper, Better…**
- **Challenge for the USAF Is to Sustain and Maintain Composite Materials on Aircraft as Well as Other Applications, Space Included**
- **Purpose of the Brief Is to Give an AFRL Perspective on Composite Sustainment and Supportability**

Air Force Research Lab (AFRL)

Major General Paul Nielsen
Commander

Ten Directorates

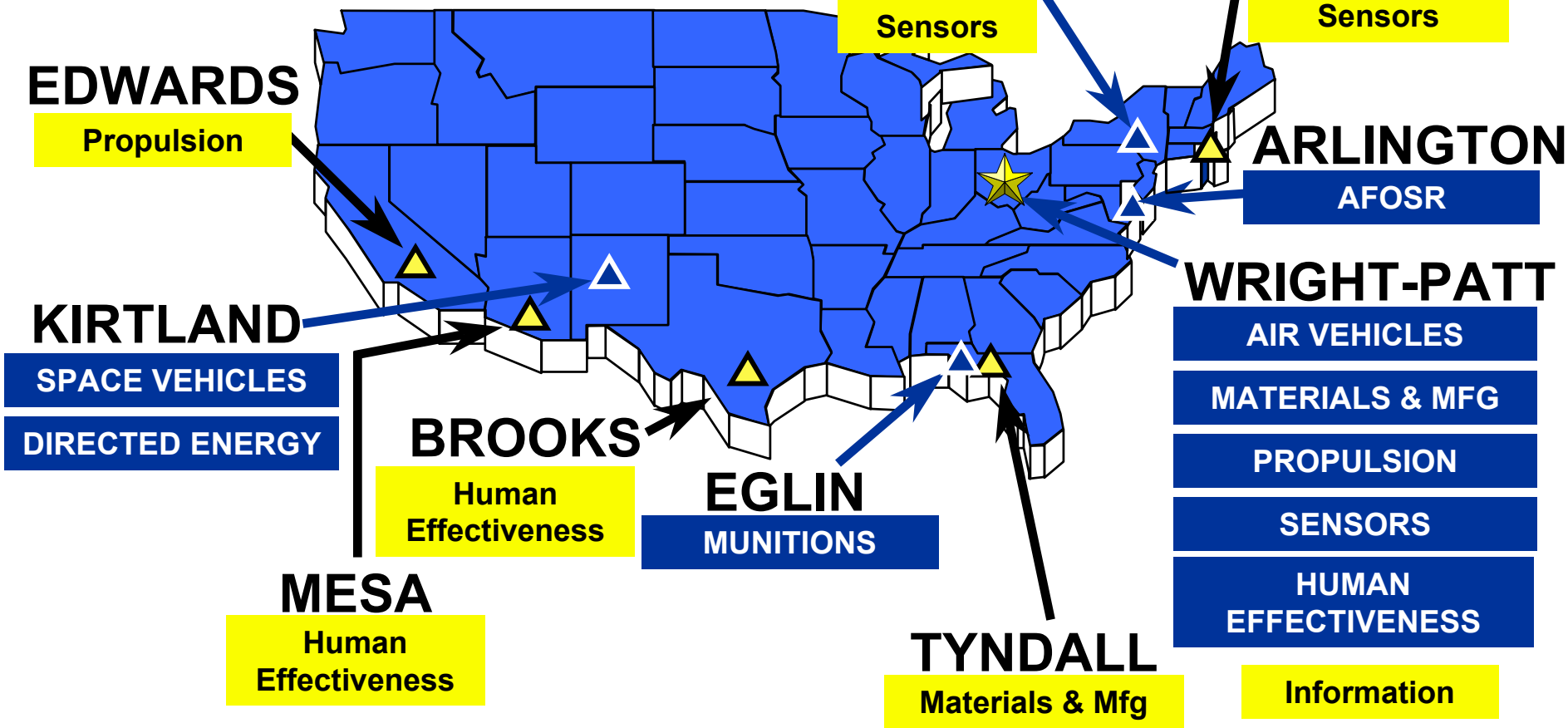
Air Vehicles (VA)
Space Vehicles (VS)
Munitions (MN)
Sensors (SN)
Propulsion (PR)
Materials & Manufacturing (ML)
Directed Energy (DE)
Human Effectiveness (HE)
Information Directorate (IF)
AFOSR

Our Score Card

- 5266 government personnel
  - 4106 civilian
  - 1160 military
- 3198 on-site contractors
- $1.3B annual S&T budget
- $500M annual customer budget

AFRL Research Sites

MISSION: ***Leading the discovery, development, and integration of affordable warfighting technologies for our air and space forces***



AFRL/ML Facilities

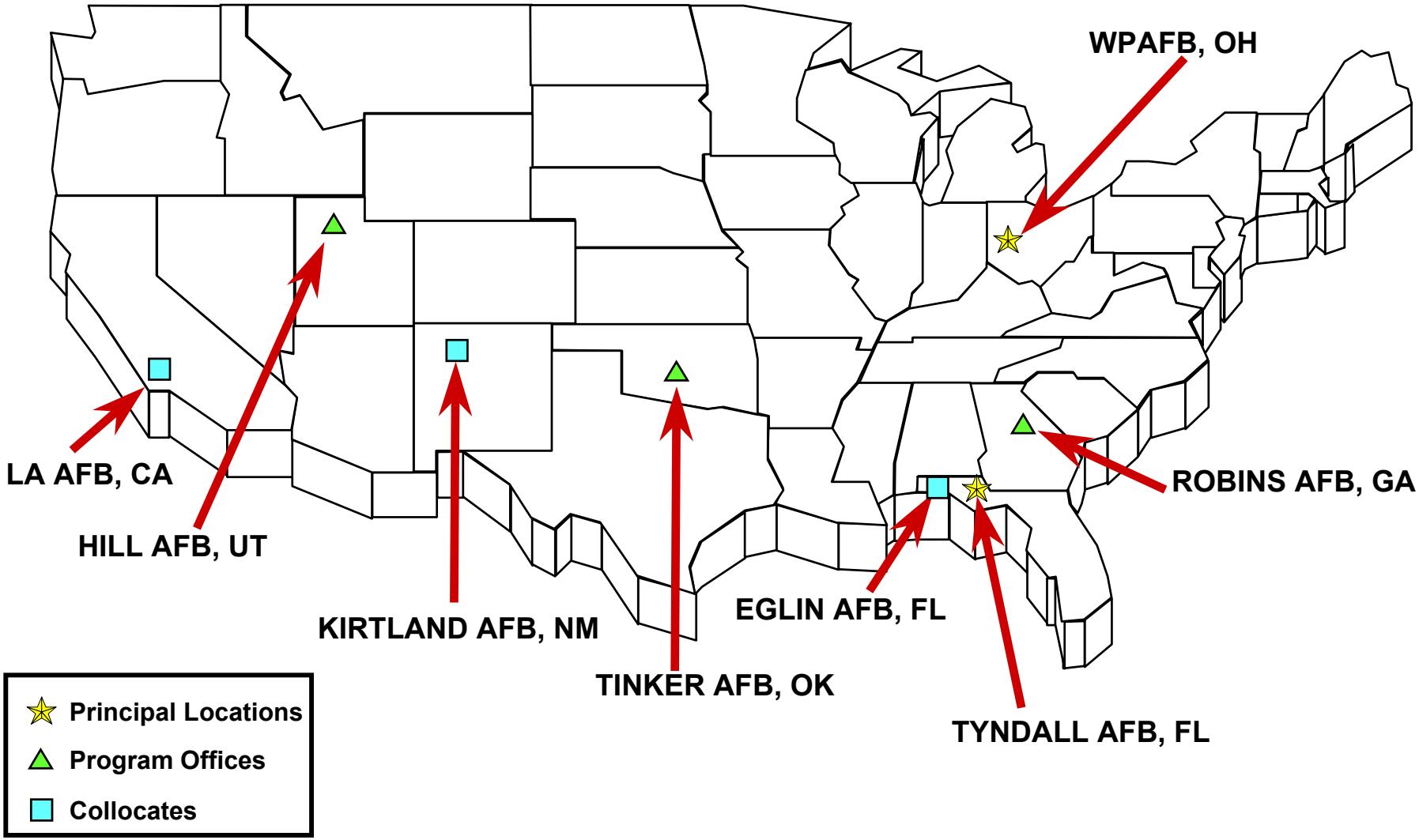
Wright-Patterson AFB

– 257,000 net square feet
– 200 lab modules
– >$100,000,000 replacement value for brick and mortar built in mid ‘80s
– >$250,000,000 replacement value for installed equipment
– Designed specifically for materials and processes R&D

Tyndall AFB

– 128,000 net square feet
– 15 lab modules
– >$30,000,000 replacement value for brick and mortar
– >$25,000,000 for equipment and test facilities
– More than 75% designed specifically for AEF technologies R&D
– Fire fighting test site/equipment
– Force protection test site

AFRL/ML Operating Locations



Air Force Research Laboratory
Materials & Manufacturing Directorate
Systems Support Division

MISSION

Systems Support to AF Product Centers, Logistics Centers, and Operating Commands to Solve System Related Problems

TECHNOLOGY AREAS

- **AF Sustainment Offices** - *Corrosion, NDI, and Composites Program Offices; Coatings Technology Integration Office (CTIO)*
- **Quick Reaction Support** - *Structural/Nonstructural Materials, Aging Wiring, Electronic Component Failure Analysis*
- **M&P for New and Fielded Systems** - *Integrate Advanced Materials, Processes, Equipment & Repair Methods Into Field-Ready Capability*; Coatings & *Corrosion Prevention Technologies; Facilitate Interaction With the Spacecraft/Launch Systems Community in Space Materials, Processes and Manufacturing; NDE; Wiring*
- **Advanced Materials Maintainability** - *Develop Technologies That Reduce USAF Maintenance Burden*

Logistics Systems Support

- **Four AF Sustainment Offices…Do Not Perform R&D**
  - AF Corrosion Prevention & Control Office, Robins AFB
  - AF Nondestructive Inspection Office, Tinker AFB
  - AF Advanced Composite Office, Hill AFB
  - Coatings Technology Integration Office, W-Patt AFB
- **History**
  - Field offices previously under Air Logistic Center management
  - Realigned and centrally managed under AFRL/ML in 1995 due to MAJCOM dissatisfaction
  - Good fit: ML performs R&D in these functional areas
  - CTIO created in direct response to MAJCOM coating performance concerns via AF Paint Strategy in 1994

MLSS Organizational Structure

AF Research Lab
Materials and Manufacturing Directorate
Dr Charles Browning
Wright-Patterson AFB

Systems Support Division
Roger Griswold
Wright-Patterson AFB

Logistics Systems Support Branch
(Aerospace Structural Materials Sustainment Office)
Major Jim Fellows
Wright-Patterson AFB

AF Corrosion Prevention and Control Office
Maj Dan Bullock
Robins AFB

AF Nondestructive Inspection Office
Mike Paulk
Tinker AFB

AF Advanced Composites Office
Larry Coulter
Hill AFB

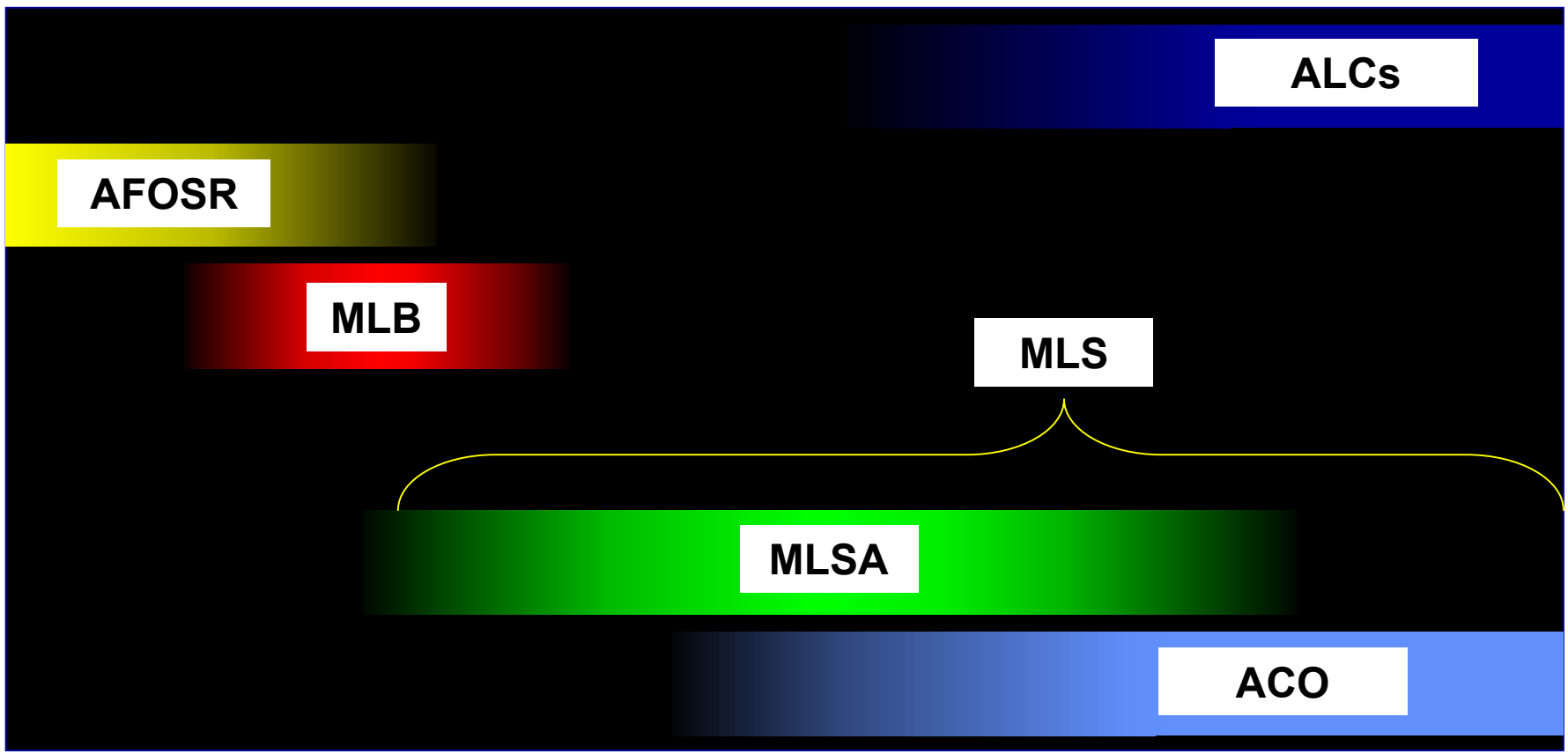
Coatings Technology Integration Office
Mike Spicer
Wright-Patterson AFB

What The ACO Does

AFI-21-105, *"Aerospace Equipment Structural Maintenance"*

- **Provide Engineering and Technical Assistance to Composites Users**
- **Manage Technical Order 1-1-690, *General Advanced Composite Repair Manual***
- **Provide and Support Advanced Composites Training**
- **Support Advanced Composites Health & Safety Issues**
- **Assist Technology Transfer**

Composites Use Spectrum



Response Time to User Needs

Steps Of Supportability

- **Many Groups in AFRL Working Composite Supportability and Sustainment Issues**
  - **Design and Analysis**
  - **Materials and Processes**
  - **NDI**
  - **Repair**
  - **Logistics Requirements**
- **Supportability Is Addressed in Military Handbook 17, Volume 3 Chapter 8**

http://www.mil17.org

Design And Analysis

- AF Has Field Level Maintainers Working in System Program Offices (SPO) During Initial Designs
  - Good example is F/A-22; senior non-commissioned officers (SNCO) are deeply involved with OEM design team
- Several AFRL Groups Perform Basic Research in Structures and Analysis
  - AFRL/VA, Air Vehicles Directorate
  - AFRL/ML, several groups work structures
    - Composite affordability initiative (CAI) methods to build affordable, certifiable structures
- OEMs Are Using Lessons Learned for New Designs

Materials And Processes

- AFRL/ML Is the Lead for the USAF in Materials and Processes
- Probably World's Largest R&D Organization Specializing in Materials and Processes
- Long History of New Material Development Starting With WW II

Non-Destructive Inspection (NDI)

- ML Performs NDI Research and Development, and Evaluates and Applies New NDI Technologies
- AFRL/MLSST Is AF NDI Sustainment Office

Repair

- AFRL/MLSA Is the USAF Organization for Development of Repair Materials and Processes
- ACO Is Lead for Transition of These New Process and Materials for Field Use
- T.O. 1-1-690 Is Manual for Composite Repair
  - Recent update is in use
  - Plan is to convert to digital medium for faster updates

Logistics Support

- **Logistics Needs Are Addressed in the System Program Offices and the Major Commands**
- **AFRL Assists in Meetings Those Logistics Needs With New Methods and Analysis**
- **Logistics May Include Topics Such as Delivering Certified Materials, Disposal and Health & Safety**

Specific Sustainment Efforts

- **MLSA**
  - Repair materials database
    - Generating allowables for repair materials and processes
    - Plan is to submit to Mil-17 data review for possible inclusion
  - BMI (bismaleimide) repair, heat damage detection, fastener hole repairs, surface prep characterization
- **MLSS**
  - TO 1-1-690 update (new repair processes)
  - Mishap response training
  - Logistics support
    - Facilities, material pipeline

Collaborations

- DoD Contacts, Navy, Army and Coast Guard
  - Kept strong by yearly DOD maintainer's conference
- Industry Groups
  - Military Handbook 17 (Mil-17)
  - Society of Automotive Engineers (SAE)
    - Especially Commercial Aircraft Composite Repair Committee
- Government Organizations Such as FAA
- National Center for Manufacturing Science (NCMS)
  - Office of Secretary of Defense funded projects to increase technology at DOD depots
  - AFRL is assisting these projects to help the three USAF Air Logistics Centers (ALCs)

Closing Thoughts

- **Trends for Sustainment**
  - **Encompasses entire life cycle from supply chain of materials to disposal of used and broken airplanes**
  - **Current trend is a greater reliance on contractor logistic support**
  - **Government has to depend on industry groups for specifications and standards**
  - **Where will the military be with UAVs, UCAVs?**
    - **Design and certification issues**
  - **Many more applications to come: civil structure, space, ships, ground vehicles**
- **Composites Are "New" but There Is a Good History With More and More Applications; We Need to Learn From Our History**

Closing Thoughts

Questions?